

Mobile apps usage and dynamic capabilities: a structural equation model of SMEs in Lagos, Nigeria

ABSTRACT

Significant knowledge exists regarding the application of dynamic capability (DC) frameworks in large firms, but their impact on smaller organisations is yet to be fully researched. This study surveyed 1,162 small and medium sized enterprises (SMEs) in Lagos in an effort to understand *how* SMEs in developing country contexts use mobile apps to enhance their businesses through DCs. Through the use of the covariance-based structural equation modelling (SEM) technique, the study explored the fitness of a conceptual formative model for SMEs. The model assembled 7 latent variables namely: mobile app usage, adaptive capability, absorptive capability, innovative capability, opportunity sensing ability, opportunity shaping ability and opportunity seizing ability. Subsequently, 15 hypotheses aimed at testing the relationships between the latent variables were developed and tested. The findings revealed that mobile app usage increases the adaptive, absorptive and innovative capabilities of SMEs. Absorptive capabilities help SMEs to maximise opportunities, while innovative capabilities negatively influence SMEs' tendency to maximise opportunities. The results failed to establish a direct relationship between mobile app usage and SMEs' ability to maximise opportunities. The research outcomes indicate that SMEs in Lagos respond to opportunities innovatively but that they seldom exhibit innovation in order to create opportunities. The heterogeneous nature of SMEs complicates any clear-cut narrative as to how SMEs in Lagos should employ mobile apps to create and maximise opportunities. However, mobile apps could induce innovation and, as such, impact significantly when developed and applied to the contextual requirements of SMEs. The research revealed the untapped potential of SMEs' mobile app usage in Lagos.

Keywords: Small and medium scale enterprises (SME), dynamic capability (DC), adaptive capability, absorptive capability, innovative capability, mobile app, conceptual model, structural equation model (SEM).

1. INTRODUCTION

The dynamic capability (DC) framework affirms that sustaining a competitive advantage in unstable business environments demands the continuous reconfiguration of resources (Helfat et al. 2007; Kuria & Kitenga, 2014). Small and medium sized enterprises (SMEs) are increasingly adopting ICT as a strategy to sustain this competitive advantage (Wang & Shi, 2011). SMEs do this through adopting strategies which appeal to customers' propensity to use mobile apps because of the flexibilities that mobile apps offer (Chou et al., 2013). Whereas the usefulness of DCs in large firms has been significantly researched, there is limited knowledge as to the relevance of the DC framework in smaller organisations, like SMEs. Bearing in mind that SMEs are considered as the foundation of national economies in developing countries, this study sought to understand *how* SMEs use mobile apps as part of their DCs. This study focused on SMEs in Lagos, Nigeria.

In the Nigerian context, SMEs are defined as businesses which employ fewer than 50 persons and which have an annual turnover of 50 million Naira (158,000 USD) (SMEDAN & NBS, 2013). SMEs create an economic buffer and contribute substantially to the development of many countries (Kingdom & Taylor, 2015) as they stimulate entrepreneurship, create jobs, trigger innovation and accelerate rural industrialisation (Ayanda & Adeyemi, 2011; Kale, 2015). The Small and Medium Enterprises Development Agency of Nigeria (SMEDAN) noted that in 2013 there were 36,994,578 micro businesses, 68,168 small businesses and 4,670 medium sized businesses in Nigeria. Despite these impressive numbers, unemployment, crime and poverty in Nigeria, as in many other developing countries, remain unsolved issues. In 2017 the number of people of a working age was estimated at 11.1 million and thus, the fact that unemployment increased from 6.7% in 2015 to 18.8% in 2017, is a cause for serious concern. The unemployment rate amongst youths also increased from 11.7% to 33.1% in the same period (NBS, 2017). Since SMEs employ over 80% of the total work force (Kale, 2015), the rise in unemployment and increase in poverty signify that SMEs are experiencing serious challenges.

Some of the problems experienced by SMEs in Nigeria include: inadequate funding, poor management skills, lack of action plans to deal with eventualities, lack of research and limited technical expertise (Apulu & Latham, 2011; Jelilov & Onder, 2016; Tom et al., 2016; Ilegbinosa & Jumbo, 2015; Eniola et al., 2015). With the advent and ever growing adoption of mobile technologies in Africa, SMEs are increasingly turning to these technologies in search of solutions to their problems (Kabanda & Brown, 2014; Owoseni & Twinomurinzi, 2016; Gazdecki, 2015). It is generally acknowledged that SMEs widely use mobile apps, but the manner in which they do so remains relatively obscure. Therefore, this research sought to investigate *how* SMEs develop their DCs through mobile app usage.

2. OBJECTIVES OF STUDY

Within the context of SMEs in Lagos, this study had 3 objectives:

1. To determine how mobile app usage influences the 3 dimensions of dynamic capabilities (i.e. adaptive, absorptive and innovative capabilities).
2. To determine whether the 3 dimensions of dynamic capabilities impact on SMEs' ability to sense, shape and seize opportunities.
3. To determine whether mobile app usage directly influences the way in which SMEs sense, shape and seize opportunities.

3. LITERATURE REVIEW

3.1. Mobile apps usage by SMEs

Mobile apps are programmes installed on, or accessible via mobile devices like smartphones and tablets. Mobile apps often leverage on internet connectivity for improved capability as in the cases of social media apps (i.e. facebook, twitter, whatsapp), travel apps (i.e. google maps, Uber, taxify) and productivity apps (evernote, any.do). The use of mobile devices has had

significant impacts on SMEs, especially when they are used to support business processes like marketing, sales, customer service, data storage, financial accounting and order management (Quade & Leimstoll, 2015). The adoption of mobile apps, by SMEs, could grow revenue by 25% (Bezerra et al., 2015), as well as assist SMEs in their drive to discover and use information efficiently (Good & Qureshi, 2009). In Nigeria, research regarding the use of mobile apps by SMEs for business purposes is limited (Owoseni & Twinomurinzi, 2017). For instance, there are 93.59 million internet users in Nigeria (Statistics Portal, 2017) and more or less 90% of these users access the internet via mobile devices (Ojo, 2015; Ojo, 2012). In a population of 182 million, with over 37 million small businesses and 80 million smartphones, the likelihood of mobile apps being used for business can therefore be expected to similarly be high. It is however not well researched how the SMEs use these mobile apps. This paper focuses on investigating the dynamic capabilities among SMEs and how those DCs are influenced through the use of mobile apps.

3.2. Dynamic Capability Theory

The dynamic capability (DC) framework is rooted in the strategic management field as it provides theoretical insights into the individuality of organisations and their distinct abilities to remain relevant, despite changing environments. DCs are “the firm’s ability to integrate, build, and reconfigure internal and external competencies to address rapidly changing environments” (Teece, 1997: p.516). In addition, they refer to the “behavioural orientation” of organisations “to constantly integrate, reconfigure, renew and recreate [their] resources and capabilities” (Wang & Ahmed, 2007: p.10) by “sensing, [shaping] and then seizing opportunities, quickly and proficiently” (Teece, 2007: p.510). DCs are *abilities* which enhance the development of new, or existing, *abilities* in a dynamic environment. DCs result in changes in competencies and/or resources, with the ultimate goal being the creation of a “sustainable competitive advantage” (Faizal et al., 2012: p.371). According to Wang and Ahmed (2007), DCs can be examined from 3 possible dimensions: adaptive capability, absorptive capability or innovative capability (Wang & Ahmed, 2007). Each of these dimensions is further influenced by the *micro-capabilities* to sense, shape and seize opportunities (Teece et al., 1997).

3.3. Dimensions of DCs: absorptive, adaptive and innovative capabilities

3.3.1 Absorptive Capability

The absorptive capability refers to the nurturing of knowledge creation through strategic alliances. It is the ability to “value, assimilate and apply new knowledge” (Saeedi, 2014: p.18). A qualitative study found that SMEs in Lagos manifest their absorptive capabilities through collaboration, packaging and price adjustments, intelligent business leads and information analysis (Owoseni & Twinomurinzi, 2017). However, the usefulness of mobile apps towards this absorptive capability in Lagos was not established. This study, therefore, sought to answer the following hypothesis:

H1_a: Mobile app usage increases the absorptive capability of SMEs in Lagos.

3.3.2 Adaptive Capability

In a dynamic environment, SMEs reflect adaptive capabilities by being flexible enough to create necessary changes and thus achieve their objectives. This flexibility could demand a quick modification in processes and/or practices (Wang & Ahmed, 2007). This capability can aid SMEs to tap into evolving market opportunities. Constructs for measuring adaptive capability in Lagos SMEs include: feedback and referrals, social media and internet usage, customer interactions, needs and problems analysis, networking and advertising (Owoseni & Twinomurinzi, 2017). Given the evolution of mobile technologies, mobile app usage could enhance these constructs in SMEs. This study, therefore, sought to answer the following hypothesis:

H1_b: Mobile app usage increases the adaptive capability of SMEs in Lagos.

3.3.3 Innovative Capability

William et al. (2013) explain the innovative capability as an SME's creative force which can: develop new product/s or service innovations, adopt new processes or procedures for delivering services and convert risks into opportunities. SMEs in Lagos demonstrate creativity through the imitation and adaptation of offerings and the adjustment of packaging and prices (Owoseni & Twinomurinzi, 2017). Perceptions are that mobile app usage could improve the innovative capability of Lagos SMEs (Grimaldi et al., 2013; Ojo, 2012) but these perceptions have not yet been proven empirically. This study, therefore, sought to answer the following hypothesis:

H1_c: Mobile app usage increases the innovative capability of SMEs in Lagos.

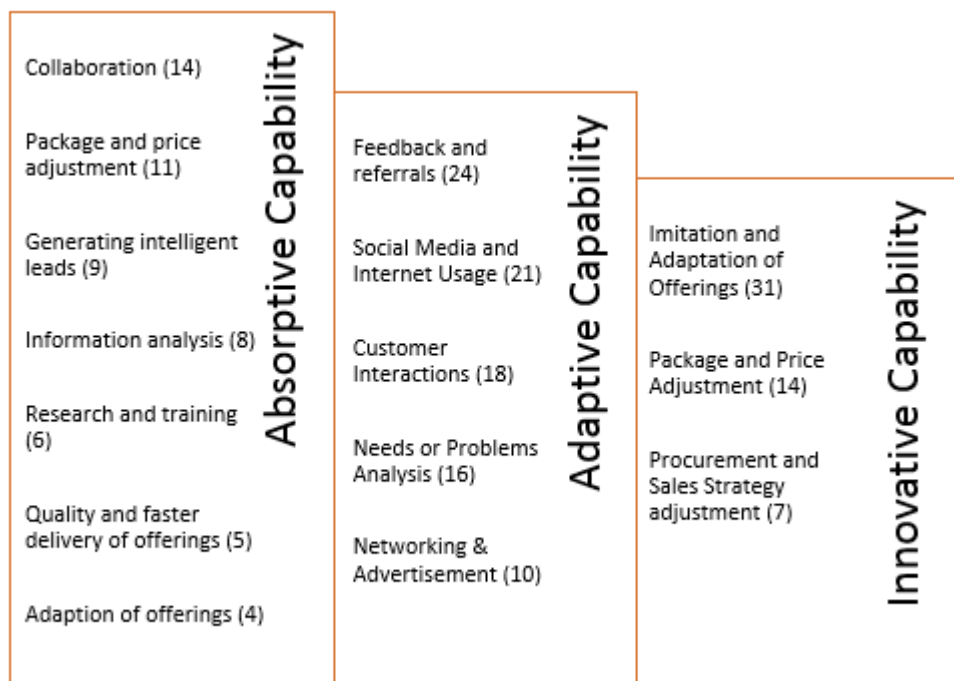


Figure 1: Absorptive, adaptive and innovative capability constructs of SMEs in Lagos
(Source: Owoseni & Twinomurinzi, 2017)

Figure 1 depicts the constructs for measuring the absorptive, adaptive and innovative capabilities of SME in Lagos, according to Owoseni and Twinomurinzi (2017). The number preceding each construct indicates its weight. For example, *collaborations* weighs 14 while *adaptation of offerings* weighs 4 within the absorptive capability dimension. Weight, in this context, thus refers to the frequency at which the constructs occurred during the content analysis (process coding) of qualitative data.

3.4 Micro-foundations of DCs: sensing, shaping and seizing opportunities

The ability to sense, shape and seize opportunities is a necessary part of the DC framework (Haas, 2015). These abilities are projected as the cognitive capabilities of SMEs to sense, shape and seize opportunities, or mitigate threats (Teece et al., 1997). The opportunity sensing capability is the ability to identify opportunities, or threats, whilst the shaping capability ensures the correct evaluation of the perceived opportunity in order that resources are used wisely. Evidently, not all opportunities deserve to be explored. Seizing opportunity entails the execution of actions required to maximise the potential of those opportunities which had earlier been sensed and shaped (Haas, 2015). SMEs develop DCs when they continuously practice the act of sensing, shaping and seizing opportunities (Wagner & Wagner, 2013; Haas, 2015). This, in turn, leads to business transformation (Niehaves et al., 2011). Business managers must decide *and* act promptly if they wish to obtain the desired business outcome (Pavlou & El Sawy, 2011).

For clarity, this research viewed opportunity sensing, shaping and seizing capabilities apart from DCs and treated them as micro-capabilities required by SMEs in order to create competitive advantage (Faizal et al., 2012). This process aimed to provide an indication of SMEs' growth and profitability since SMEs with strong competitive advantages usually experience growth and profitability (Didi-quvane & Twinomurinzi, 2013; Teece, 2007).

DC constructs, as extrapolated from absorptive, adaptive and innovative dimensions, could affect the way in which SMEs sense, shape and seize opportunities. Therefore, the following associations between DC and opportunity maximisation were hypothesised.

H2_a: Absorptive capability increases SMEs' opportunity sensing ability in Lagos.

H2_b: Absorptive capability increases SMEs' opportunity shaping ability in Lagos.

H2_c: Absorptive capability increases SMEs' opportunity seizing ability in Lagos.

H3_a: Adaptive capability increases SMEs' opportunity sensing ability in Lagos.

H3_b: Adaptive capability increases SMEs' opportunity shaping ability in Lagos.

H3_c: Adaptive capability increases SMEs' opportunity seizing ability in Lagos.

H4_a: Innovative capability increases SMEs' opportunity sensing ability in Lagos.

H4_b: Innovative capability increases SMEs' opportunity shaping ability in Lagos.

H4_c: Innovative capability increases SMEs' opportunity seizing ability in Lagos.

Having established the possible relationships between the 3 dimensions of DC and SMEs' capability to sense, shape and seize opportunities, the study considered whether mobile usage directly influences SMEs' capability to sense, shape and seize capabilities.

H5_a: Mobile app usage increases SMEs' opportunity sensing ability in Lagos.

H5_b: Mobile app usage increases SMEs' opportunity shaping ability in Lagos.

H5_c: Mobile app usage increases SMEs' opportunity seizing ability in Lagos.

4 The Conceptual Model

The conceptual model, presented in Figure 2, combines mobile app usage, the 3 dimensions of DC, opportunity sensing, shaping and seizing capabilities, as constructs towards the creation of a conceptual model.

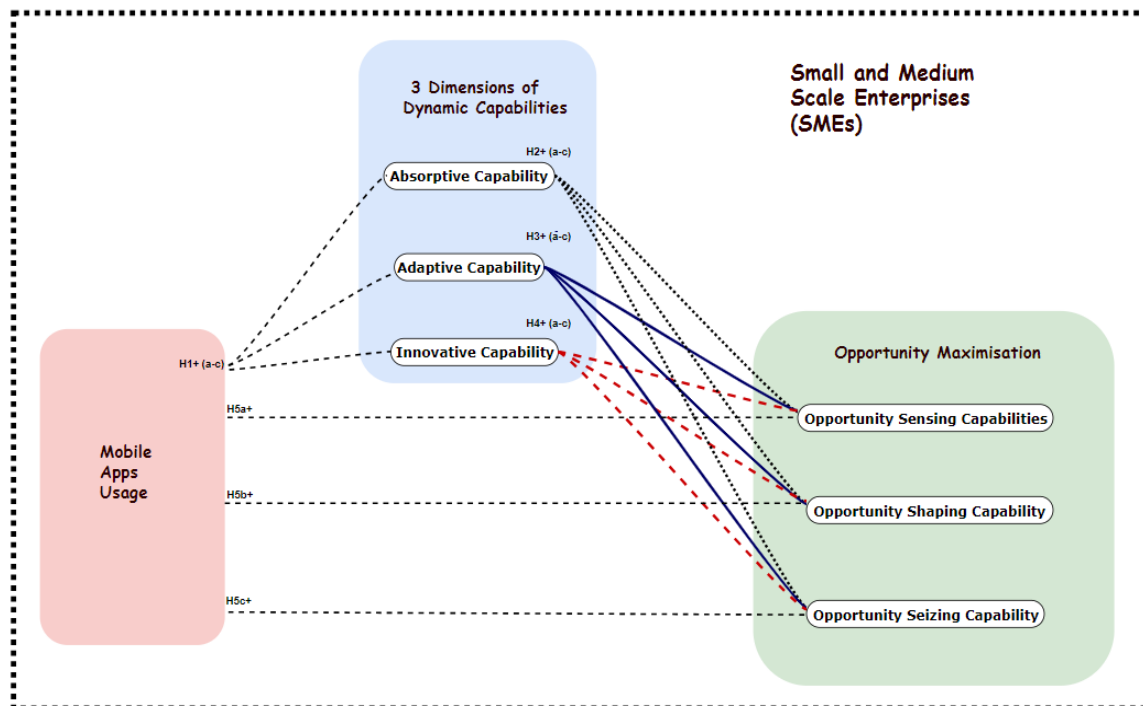


Figure 2: Mobile app usage and DC, a conceptual model of SMEs in Lagos

4.1 Definition and explanation of constructs

Within the context of this research, which sought to gain an understanding of *how* SMEs in Lagos use mobile apps to develop DCs, 7 constructs were defined which make up the conceptual model:

1. **Mobile app usage** refers to *how* SMEs in Lagos engage mobile apps while carrying out business activities.
2. **Absorptive capability** describes *how* SMEs in Lagos create knowledge through strategic alliances which combine new external knowledge with existing internal knowledge towards attaining business gains (William et al., 2013).

3. ***Adaptive capability*** illustrates *what* SMEs in Lagos do with the knowledge acquired. This reflects on changes in business processes, or procedures, and investment in new markets (Wang & Ahmed, 2007).
4. ***Innovative capability*** is demonstrated by the way in which SMEs in Lagos push at conventional business boundaries through the creation of new products, services, markets or business models (Grimaldi et al., 2013).
5. Lagos SMEs' opportunity ***sensing capability*** relates to their ability to identify prospects (Didi-quvane & Twinomurinzi, 2013).
6. The ***capability to shape opportunities*** helps SMEs in Lagos to interpret and decide whether a prospect, which had been identified earlier, should be explored (Haas, 2015).
7. ***Opportunity seizing (and/or risk mitigation) capability*** of SMEs in Lagos drives the execution of actions towards maximising the benefits of selected and/or shaped opportunities (Wagner & Wagner, 2013).

4.2 Associations between constructs

In light of the creation of the conceptual model, the identification of directional associations between constructs are important to avoid misspecifications. A measurement model is misspecified when it does not account for all construct interactions within the context in which the model was created (Freeze & Raschke, 2007). A measurement model could be *reflective* or *formative* in nature. When the observed indicators are influenced by latent variables, the resultant model is considered as *reflective*. In the case of the *formative* model, the latent variables are influenced by observed indicators (Freeze & Raschke, 2007; Bankole & Bankole, 2017). Reflective measures are expected to possess high inter-correlations while formative measures are not expected to correlate (Jarvis et al., 2003; Bagozzi, 2011).

The conceptual model of SMEs in Lagos is formative as the latent variables derive meaning from the measured variables. Additionally, the DC framework consists of 3 influential measures: absorptive, adaptive and innovative capabilities and an increase in one of these capabilities signals an increase in the DCs. Likewise, opportunity maximisation (or the micro-foundation of DC) consists of 3 micro-measures: opportunity sensing, shaping and seizing capabilities and an increase in any of these capabilities would result in the increased capability of SMEs to maximise opportunities. The covariance based structural equation modelling (SEM) technique as discussed in the next section was therefore considered appropriate for evaluating the formative conceptual model (Cenfetelli et al., 2013; Cenfetelli & Bassellier, 2009). Table 1 presents the association of constructs in the SME conceptual model.

Table 1: Associations between constructs (Source: Fieldwork)

Hypothesis	Association
<i>H1_a</i>	Mobile app usage increases the adaptive capability of SMEs in Lagos.
<i>H1_b</i>	Mobile app usage increases the absorptive capability of SMEs in Lagos.
<i>H1_c</i>	Mobile app usage increases the innovative capability of SMEs in Lagos.
<i>H2_a</i>	Absorptive capability increases SMEs' opportunity sensing ability in Lagos.
<i>H2_b</i>	Absorptive capability increases SMEs' opportunity shaping ability in Lagos.

H2_c	Absorptive capability increases SMEs' opportunity seizing ability in Lagos.
H3_a	Adaptive capability increases SMEs' opportunity sensing ability in Lagos.
H3_b	Adaptive capability increases SMEs' opportunity shaping ability in Lagos.
H3_c	Adaptive capability increases SMEs' opportunity seizing ability in Lagos.
H4_a	Innovative capability increases SMEs' opportunity sensing ability in Lagos.
H4_b	Innovative capability increases SMEs' opportunity shaping ability in Lagos.
H4_c	Innovative capability increases SMEs' opportunity seizing ability in Lagos.
H5_a	Mobile app usage increases SMEs' opportunity sensing ability in Lagos.
H5_b	Mobile app usage increases SMEs' opportunity shaping ability in Lagos.
H5_c	Mobile app usage increases SMEs' opportunity seizing ability in Lagos.

5. METHODOLOGY

5.1. Research Philosophy

The aim of this study was to gain practical insights into *how* SMEs in Lagos use mobile apps to enhance their DCs. Pragmatism, therefore, offered the best philosophical approach to guide the study. Pragmatism is a factual and practical approach to solving problems. Reality, according to the pragmatist, is that which works (Kilpinen, 1987; Barton, 1994; Goldkuhl, 2012). Reality, in the study context, is how mobile apps practically enhance the DCs among SMEs in Lagos. Pragmatism in its openness to method, allowed the study establish in the quantitative approach the extent to which mobile apps practically enhance the DCs.

5.2. Data Collection

The study used non-probability convenience sampling to select 2,500 SMEs in Lagos. Questionnaires were administered to the managers and/or owners of the selected SMEs. All questions used 5-point Likert-scaled responses, except those which focused on demographics. The mode of administration was face-to-face, questions were created on google forms and responses were input directly by means of smart handheld devices. In order to increase the response rate, 12 data collection field officers were hired, trained and kitted out with customised t-shirts and nametags. The data collection exercise took 4 weeks to complete and received feedback from 1,162 SMEs. Three respondents voluntarily opted out of the research which reduced the sample size to 1,159.

5.3. Data Evaluation

Covariance-based structural equation modelling (SEM) by AMOS (version 24) was used to evaluate the conceptual model. According to Garson (2016), covariance-based SEM is appropriate for testing hypotheses and exploratory models, in contrast to partial least square (PLS) SEM which is preferred for predictive model evaluation. Covariance SEM also yields better outcomes for large samples (Livote & Blunch, 2009). Cenfetelli et al. (2013) demonstrated that covariance SEM is appropriate for formative model measurement, regardless of its limited use in Information Systems (IS) research. The use of covariance-based SEM in this study is therefore justified because the model under investigation is formative in nature as it sought to test hypotheses and collected data from large samples.

Prior to conducting the SEM, the data were screened for outliers and normality to meet the assumptions of the general linear model. To detect outliers, the observations farthest from the

centroid were identified using the Mahalanobis distance. No outlier was found and the Mahalanobis distance test indicated acceptable and progressive distances from the centroid (Byrne, 2010). For normality, the skewness and kurtosis of each item in the model were within the acceptable range of -2 and +2 (George & Mallery, 2010), as presented in Appendix A. Although one of the variables (AdC3) was above the acceptable range, the overall outcome indicated satisfactory skewness and kurtosis values which satisfied the assumption of normality.

6. DISCUSSION OF FINDINGS

6.1. Demographics

The respondents consisted of 53.4% females and 46.6% males. 42%, 16.2% and 28.5% respectively had secondary school certificates, diplomas and bachelor's degrees as highest qualifications. A total of 46.7% were aged 30 years and younger while 35.7% were 30 - 39 years old. Of the SMEs under investigation, 88.5% had less than 11 employees, 9.9% had 11 - 20 employees and 1.6% had more than 20 employees. Considering the age of the SMEs, 60.3% were less than 6 years old, 23.2% were 11 - 15 years old while 16.5% had been in existence longer than 15 years. A total of 68.6% of the respondents owned the SME. Overall, the demographics depicted a heterogeneous dataset. Table 2 provides a summary of the demographic detail.

Table 2: Demographics of sample population (Source: Fieldwork)

<i>Characteristics</i>	<i>Options</i>	<i>Frequency</i>	<i>Percent (%)</i>
<i>Gender of respondent</i>	Male	619	53.4
	Female	540	46.6
<i>Education of respondent</i>	No formal education	43	3.7
	Secondary School Certificate	487	42.0
	Diploma	188	16.2
	Bachelor's degree	330	28.5
	Master's Degree	105	9.1
	Doctoral Degree	6	0.5
<i>Age of respondent</i>	20 years and less	130	11.2
	21 - 29 years	412	35.5
	30 - 39 years	414	35.7
	40 - 49 years	150	12.9
	50 - 59 years	45	3.9
	60 years and above	8	8.7
<i>Age of SME</i>	5 years and less	698	60.3
	6 - 10 years	269	23.2
	11 - 15 years	107	9.2
	16 - 20 years	53	4.6
	21 - 25 years	16	1.4
	More than 25 years	14	1.2
<i>Size of SME (in terms of number of employees)</i>	1 - 10 employees	1 026	88.5
	11 - 20 employees	115	9.9

	21 - 50 employees	18	1.6
<i>Respondent's ownership of business</i>	No, I am not the owner	364	31.4
	Yes, I am the owner or co-owner	795	68.6

6.2. Measurement model using confirmatory factor analysis (CFA)

The measurement model, through CFA, confirms the structure of various constructs involved in the model, thus accessing the convergent validity and reliability of the model. From the initial proposed model (Figure 2), the CFA results displayed unsatisfactory fit indices. Diagnosis of the modification indices and the standardised residual covariance matrix, retrieved from the AMOS outputs, suggested that some items (e.g. MAU4, AdC1, AdC2, etc.) be deleted from the analysis in order to improve model fit. These items were removed because of the high-standardised residual covariance matrix (above |2.4|) and cross loading issues (Hair et al., 2014). Typical of the formative model, deletion of some items reduced the measurement error and increased reliability amongst the remaining items which, in turn, enhanced the model fit (Ford et al., 1986). After refining the model, the final measurement model was designed. The refined model ($\chi^2 = 2475.083$, degree of freedom (df) = 528, p-value = .000), presented satisfactory fit indices: $\chi^2/df = 4.688$, GFI = .875, TLI = .921, CFI = .930, NFI = .913, RMSEA = .056, as presented in Figure 3.

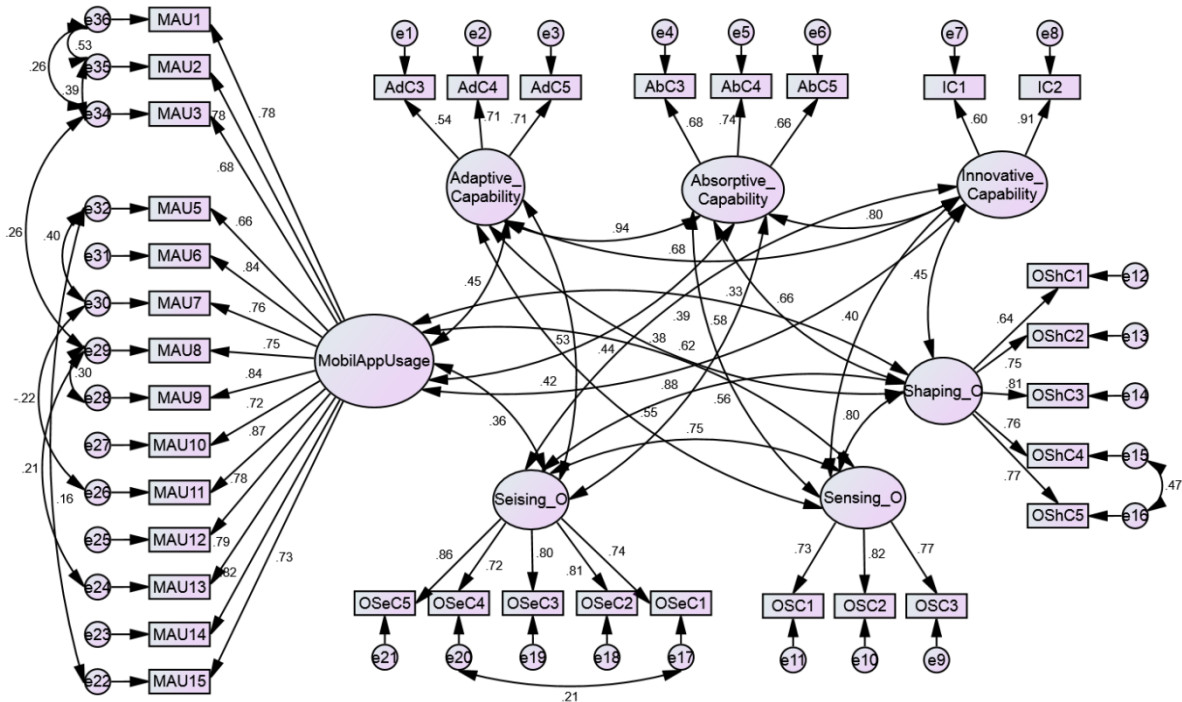


Figure 3: Measurement model using CFA

Based on acceptable reliability and validity assessment (Appendices B and C), all items represented in the measurement model are presumed to be valid in the context of this study. Overall, the relationships of latent variables, as illustrated in the measurement model (Figure

3), fitted the data satisfactorily. All the instruments used in the measurement model were deemed reliable and valid in the context of this study. Given that the CFA provided satisfactory results, the structural model was built.

The pragmatic nature of this research, which focused on understanding the realities of SMEs, called for an in-depth assessment of the model although the adjusted formative model satisfied statistical requirement after some items had been removed. The items which were removed carried the highest weights when the constructs were elicited qualitatively (Owoseni & Twinomurinzi, 2017). For example, “collaboration” and “package and prices adjustment of offering” weighted the highest as absorptive capability constructs of SMEs, but were removed in order to ensure reliability and validity of the measurement model. The removal could support the view that SMEs are highly heterogeneous entities (Derham & Cragg, 2011) which exposes their evasiveness when developing DCs homogeneously. Although SMEs “collaborate”, the ways in which they do so differ. This is also true of the adaptive capability where the “feedback and referrals” and “social media and internet usage” items were removed from the final structural model.

6.3. Structural Model

The structural model was tested using the maximum likelihood performed with AMOS 24. Figure 4 presents the structural model.

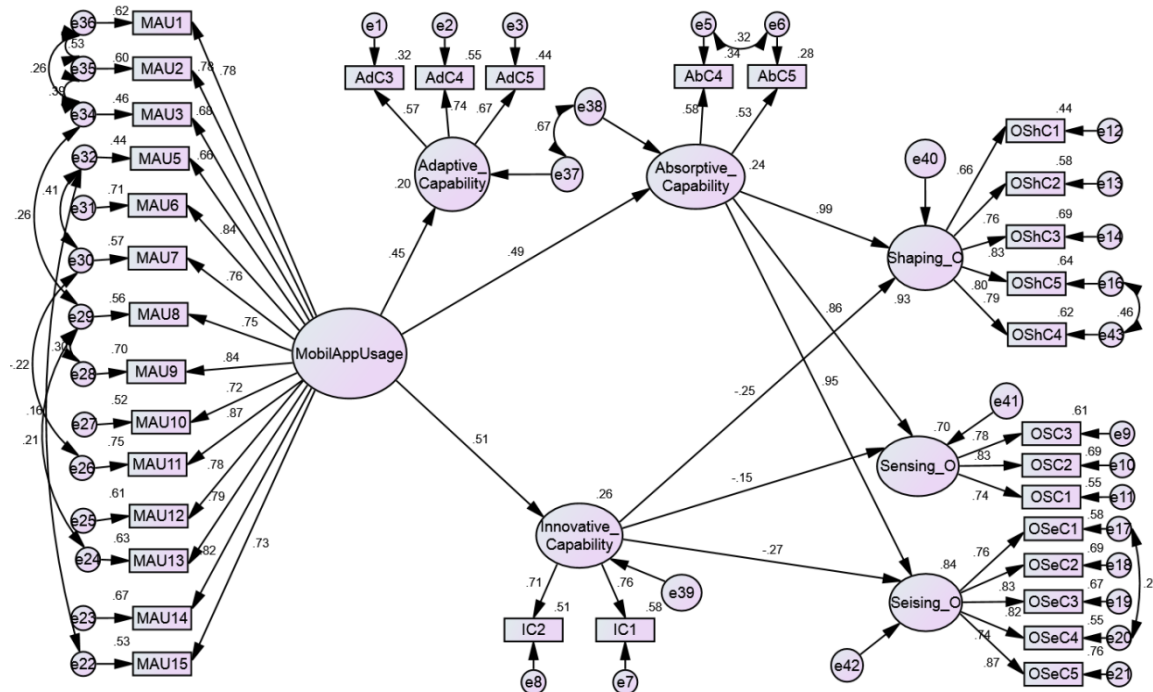


Figure 4: The structural model

The structural model results displayed satisfactory fit indices: ($\chi^2/df = 5$, GFI = .861, TLI = .901, CFI = .910, NFI = 0.894, RMSEA = 0.064). Appendix D presents details of regression

weights and correlation coefficients, as displayed in the structural model. The Chi-square (χ^2) of the structural model was 2927.535, with 505 degrees of freedom and a p-value of .000. This implied that the structural model fitted the data satisfactorily. Therefore, the structural model (Figure 4) can be used with confidence to draw conclusions regarding the research hypotheses. Note that a relationship is significant when the p-value is smaller than 0.05. If the p-value is above .05, the relationship is not deemed significant (Appendix D).

The fitted structural model (Figure 4) differed from the conceptual model (Figures 2 and 3). Six paths were purposefully deleted as they were non-significant and negatively impacted upon the goodness of fit of the structural model. Deleted paths were divided into 2 groups. The first group connected mobile app usage to opportunity sensing, shaping and seizing capabilities. The second group connected adaptive capability, opportunity sensing, shaping and seizing capabilities. According to the structural model (Figure 4), the removal of paths suggests that mobile app usage and adaptive capability have no impact on the SMEs' overall approach to sensing, shaping and seizing opportunities.

The results further indicate that mobile app usage has a positive impact on the 3 dimensions of DC. However, mobile app usage affects the innovative capability the most as this path demonstrates the highest beta value (.51) compared to the other two dimensions. The innovative capability negatively impacted on the opportunity sensing, shaping and seizing abilities of SMEs. Nonetheless, the strongest negative effects were reported for seizing opportunity (-.27), followed by shaping (-.25) and sensing (-.15) opportunities. These results suggest the existence of a wide gap in the innovative use of mobile apps by SMEs, although the potential impact on DCs is significant. Previous research had found that SMEs in Lagos innovate through imitation (Owoseni & Twinomurinzi, 2017) but contextual mobile apps, which support the capability, hardly exist. SMEs reportedly adapt generic mobile apps to suit their need. For example, contextually mobile apps would consider the culture and environment of target users in their design.

Unlike the innovative capability, the absorptive capability had a positive effect on sensing, shaping and seizing opportunities. However, it had the strongest effect on shaping opportunity (beta value = .99). This suggests that the absorptive capability, which represents SMEs' ability to nurture knowledge through strategic alliances, is most helpful in shaping opportunities. Additionally, shaping opportunity was the most important dependent variable in the model because it had the highest variance explained (.93). The selected predictors explained up to 93% of the variance of shaping opportunities, and rightly so, as a *sensed* opportunity cannot be *seized* if not adequately *shaped*. Shaping opportunity is followed by seizing and sensing opportunities which, respectively, explain 84% and 70% of the variance.

Table 3 presents a summary of the outcomes of the testing of the hypotheses, as based on SEM results.

Table 3: Summarised outcomes of the hypotheses test

	Hypothesis	Status
H1_a	Mobile app usage increases the adaptive capability of SMEs in Lagos.	True
H1_b	Mobile app usage increases the absorptive capability of SMEs in Lagos.	True
H1_c	Mobile app usage increases the innovative capability of SMEs in Lagos.	True
H2_a	Absorptive capability increases SMEs' opportunity sensing ability in Lagos.	True
H2_b	Absorptive capability increases SMEs' opportunity shaping ability in Lagos.	True
H2_c	Absorptive capability increases SMEs' opportunity seizing ability in Lagos.	True
H3_a	Adaptive capability increases SMEs' opportunity sensing ability in Lagos.	<i>*Not determined</i>
H3_b	Adaptive capability increases SMEs' opportunity shaping ability in Lagos.	<i>*Not determined</i>
H3_c	Adaptive capability increases SMEs' opportunity seizing ability in Lagos.	<i>*Not determined</i>
H4_a	Innovative capability increases SMEs' opportunity sensing ability in Lagos.	False
H4_b	Innovative capability increases SMEs' opportunity shaping ability in Lagos.	False
H4_c	Innovative capability increases SMEs' opportunity seizing ability in Lagos.	False
H5_a	Mobile app usage increases SMEs' opportunity sensing ability in Lagos.	<i>*Not determined</i>
H5_b	Mobile app usage increases SMEs' opportunity shaping ability in Lagos.	<i>*Not determined</i>
H5_c	Mobile app usage increases SMEs' opportunity seizing ability in Lagos.	<i>*Not determined</i>
<i>*Not determined:</i> Consists of missing path which negatively affects the goodness of fit of the structural model.		

6.4. Implications of research findings

The first research objective sought to determine *how* mobile app usage influences the three dimensions of dynamic capabilities (DCs). The results showed that mobile app usage positively impacted on the absorptive, adaptive and innovative capabilities of SMEs in Lagos with beta values of 0.49, 0.45 and 0.51, respectively. The innovative capability represented the highest impact when compared to absorptive and adaptive capabilities. This implies that if one wishes to quickly and significantly enhance the DCs of SMEs, then one should focus on using mobile apps for SME business innovation. Business innovation, through the use of mobile apps, could be achieved by integrating multiple services and offerings onto a mobile enabled platform. The idea is to ensure convenience and security while serving the customer. For example, the mobile app, quickTeller™, has in the past 10 years brought about a payment

innovation for Nigerian SMEs in that it has greatly changed the way in which funds are collected and exchanged. A similar innovation, mCash, promotes fund transfers, payments and collection in the rural areas of Nigeria through USSD (Unstructured Supplementary Service Data). Similar innovations could be deployed in other non-financial SME sectors.

The second research objective was to determine whether the three DC dimensions had impacted on SMEs' ability to sense, shape and seize business opportunities. Based on research outcomes, it was noted that absorptive capability had a positive and significant impact on the opportunity sensing, shaping and seizing abilities of SMEs in Lagos. This implies that SMEs in Lagos generally maximise opportunities by combining new *external* knowledge with existing *internal* knowledge. The paths representing the relationship/s between the adaptive capability and opportunities sensing, opportunities shaping and opportunities seizing abilities of SMEs in Lagos were deleted in the course of the structural model's creation to ensure model fit. This further implies that the relationship between the adaptive capability and the opportunity maximisation of SMEs in Lagos could not be generalised. The inability to generalise the capabilities of SMEs calls for a narrower approach towards studying the impacts such as along the lines of business sector, business ownership, business size and/or product type.

The innovative capability had a significantly negative impact on SMEs' ability to sense, shape and seize opportunities. This research outcome implies that SMEs in Lagos respond to opportunities innovatively but that they seldom exhibit innovation in order to create opportunities.

The third research objective sought to determine whether mobile app usage directly influenced the way in which SMEs sensed, shaped and seized opportunities. This objective scrutinised the direct relationship between mobile app usage and SMEs' capability to maximise opportunities. The paths which represented the relationship/s between mobile app usage and SMEs' ability to sense, shape and seize opportunities were deleted during the creation of the structural model (Figure 4) in order to ensure model fit. SMEs in Lagos, as a homogenous group, thus demonstrated an indeterminate approach towards the use of mobile apps. Taking into account the heterogeneous nature of SMEs, it remains a difficult task to provide clear-cut narratives explaining the use of mobile apps to directly maximise opportunities. A more in-depth study of this domain is required during which SMEs are studied under narrower categories of interest.

6.5. Limitations of study

The study was limited to data gained from only one area in Nigeria, Lagos. Samples were collected from SMEs in Lagos alone as this city represents the biggest commercial centre of Nigeria. Although Lagos contains the highest number of SMEs in Nigeria (Kale, 2015), data from Lagos alone may not characterise the absolute experience of all SMEs in Nigeria.

7. CONCLUSION

This research set out to make sense of *how* SMEs in Lagos use mobile apps to enhance their business through their dynamic capabilities (DCs). The study developed a conceptual model of SMEs which contained 7 latent variables: (1.) mobile app usage, (2.) adaptive capability, (3.)

absorptive capability, (4.) innovative capability, (5.) opportunity sensing ability, (6.) opportunity shaping ability and (7.) opportunity seizing ability. Based on responses collected from 1,159 SMEs, the study used covariance-based SEM to explore the fitness of the model and the relationships between the variables.

The results suggest that SMEs' approach towards mobile app usage and DCs is evasive. It confirms the heterogeneous nature of SMEs and recommends further sub-sector specific research when using SEM to evaluate diversified samples. The findings also confirm the tendency of SMEs to use mobile apps for business. It exposes the need for the creation of mobile apps, in accordance with the contextual requirements of SMEs, a process which could be supported by Artificial Intelligence and Machine Learning. For example, intelligent mobile apps could retrieve relevant business information from the environment and suggest actions which could promote the absorptive, adaptive and innovative capabilities of the SME within that sector. The new Android platform, Oreo 8.0, supports such intelligence (Android, 2018).

In reflection, knowledge of *how* SMEs use mobile apps is important at this time as mobile app usage arguably continues to grow and expand in Africa. There exists the potential to improve national economic outlooks when SMEs purposefully use mobile apps.

This paper contributed to IS in its development of a model for investigating the mobile app usage of organisations from a DC perspective. The formative model presented in this research could aid future investigation into *how* the use of mobile apps could possibly affect organisations in other contexts. Additionally, the research showcased the application of the DC framework to small organisations. Thus, the application of the DC framework to SMEs in this study was novel, especially in the context of a developing African economy.

For further research, the study needs to consider the same model on narrower sectors of SMEs such as by business type, business age, or business size.

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Appendix A

Normality Assessment

Variables (constructs)	Mapping	skew	kurtosis
Mobile app usage			
We use mobile apps to provide feedback to customers.	MAU1	-.490	-1.359
We use mobile apps to get referrals	MAU2	-.559	-1.313
We use mobile apps to chat or text.	MAU3	-1.066	-.494
We use mobile apps to store contacts, document or recorded conversation.	MAU4	*Deleted	
We use mobile apps for virtual meetings.	MAU5	.542	-1.443
We use mobile apps for advertisement and marketing.	MAU6	-.195	-1.675
We use mobile apps to organise and plan our schedules (reminders)	MAU7	.151	-1.686
We use mobile apps to search the internet for get desired information	MAU8	-.609	-1.332
We use mobile apps for analysing information.	MAU9	-.282	-1.610
We use mobile apps for accounting and book/keeping	MAU10	.360	-1.619
We use mobile app to sell our products and services.	MAU11	-.249	-1.659
We use mobile apps for payments and collections	MAU12	-.219	-1.680
We use mobile apps for learning	MAU13	-.260	-1.636
We use mobile apps for managing job orders	MAU14	-.173	-1.670
We use mobile apps to create online content like blogs/news/articles	MAU15	.127	-1.773
Seizing Opportunity			
We prevent threats through usage of mobile apps.	OSeC5	-1.004	-.313
We deploy (position) resources through mobile apps usage	OSeC4	-1.424	.953
Using mobile apps helps us to block loop holes in business	OSeC3	-.856	-.507
Using mobile apps helps use to reduce risks	OSeC2	-.885	-.435
Using mobile apps helps use to speedily implement our ideas	OSeC1	-1.453	1.100
Shaping Opportunity			
We analyse threats while using mobile apps	OShC5	-.865	-.610
We analyse opportunities through while using mobile apps	OShC4	-1.014	-.163
Through the mobile apps, we identify risks associated with opportunities	OShC3	-1.072	-.037
Through the use of mobile apps, we understand opportunities better	OShC2	-1.165	.424
Mobile apps help us to separate profitable business opportunities from unprofitable ones	OShC1	-1.270	.402

Sensing Opportunity			
Through the use of mobile apps, we foresee opportunities	OSC1	-.932	-.276
Mobile apps help use to identify opportunities	OSC2	-1.151	.282
We become conscious of opportunities through mobile apps	OSC3	-1.359	.813
We create opportunities by using mobile apps	OSC4	*Deleted	
We discover hidden opportunities when we use mobile apps	OSC5	*Deleted	
Innovative Capability			
Mobile apps allow us to easily imitate and adapt offerings	IC3	*Deleted	
We use mobile apps to adjust how we package or price our products	IC2	-1.254	.595
Mobile apps help our sales and procurement	IC1	-1.687	1.997
Absorptive Capability			
Mobile apps help us to work /interact virtually with other people	AbC7	*Deleted	
We easily change the packaging and pricing of our offering with mobile apps	AbC6	*Deleted	
Through mobile apps usage, we identify sales opportunities	AbC5	-1.268	.213
Information become clearer when we use mobile apps	AbC4	-1.408	1.126
Mobile apps help in research and training	AbC3	-1.557	1.503
Mobile apps help us to meet customers’ expectations faster	AbC2	*Deleted	
We use mobile apps to make our offering suitable to specific customer or situation	AbC1	*Deleted	
Adaptive Capability			
We network with people and advertise through mobile apps	AdC5	-1.454	.856
Mobile apps help us to identify business needs or problems	AdC4	-1.470	1.322
We interact with customers through mobile apps	AdC3	-2.555	6.950
Mobile apps help us maximize social media and Internet usage	AdC2	*Deleted	
We got feedback and referrals through mobile apps	AdC1	*Deleted	

*Items were deleted to improve model fits.

Appendix B

Reliability and Validity Assessment

Constructs	Items	Factor loading	P-value	Cronbach α	CR	AVE	Final number of Items (and Initial)
Adaptive Capability	AdC3	.538	***	0.695	0.694	0.434	3 (5)
	AdC4	.713	***				
	AdC5	.710	***				
Absorbtive Capability	AbC3	.684	***	0.734	0.736	0.482	3 (7)
	AbC4	.736	***				
	AbC5	.660	***				
Innovative Capability	IC1	.605	***	0.712	0.743	0.601	2(3)
	IC2	.914	***				
Sensing Opportunities	OSC3	.771	***	0.817	0.819	0.602	3 (5)
	OSC2	.823	***				
	OSC1	.731	***				
Shaping Opportunities	OShC1	.642	***	0.872	0.865	0.563	5(5)
	OShC2	.746	***				

	OShC3	.813	***				
	OShC4	.765	***				
	OShC5	.775	***				
Seizing Opportunities	OSeC1	.745	***	0.894	0.892	0.623	5 (5)
	OSeC2	.812	***				
	OSeC3	.804	***				
	OSeC4	.723	***				
	OSeC5	.856	***				
Mobil App Usage	MAU1 1	.868	***	0.955	0.954	0.599	14(15)
	MAU1 0	.721	***				
	MAU9	.836	***				
	MAU8	.750	***				
	MAU7	.758	***				
	MAU6	.845	***				
	MAU5	.665	***				
	MAU1	.785	***				
	MAU2	.776	***				
	MAU3	.680	***				
	MAU1 5	.728	***				
	MAU1 4	.817	***				
	MAU1 3	.791	***				
	MAU1 2	.781	***				

Notes:
***: significance at 0.01 level.
CR= composite reliability, AVE: Average variance extracted

Appendix C

Correlation & Square root of AVEs Matrix

	OSC	AdC	MAU	AbC	OSeC	InC	OShC
OSeC	0.776						
AdC	0.553	0.659					
MAU	0.377	0.454	0.774				
AbC	0.557	0.939	0.440	0.694			
OSeC	0.747	0.532	0.364	0.583	0.789		
InC	0.401	0.682	0.419	0.796	0.393	0.775	
OShC	0.799	0.621	0.331	0.656	0.876	0.448	0.750
Notes: OSC: Opportunity Sensing Capability AdC: Adaptive Capability MAU: Mobile App Usage AbC: Absorptive Capability OSeC: Opportunity Seizing Capability							

InC: Innovative Capability
OShC: Opportunity Shaping Capability

Appendix D

Regression Weights: (Group number 1 - Default model)

Dependent variables		Independent Variables	Est.	P value	Hypothesis conclusion
Absorptive Capability	<---	Mobil App Usage	.489	***	Mobil App Usage has a positive and significant effect on Absorptive Capability as its p-value (***) is lower than .05. Meaning when Mobil App Usage goes up by 1 standard deviation, Absorptive Capability also goes up by 0.489 of its own standard deviation.
Innovative Capability	<---	Mobil App Usage	.512	***	Mobil App Usage has a positive and significant effect on Innovative Capability as its p-value (***) is lower than .05. Meaning when Mobil App Usage goes up by 1 standard deviation, Innovative Capability also goes up by 0.512 of its own standard deviation.
Adaptive Capability	<---	Mobil App Usage	.450	***	Mobil App Usage has a positive and significant effect on Adaptive Capability as its p-value (***) is lower than .05. Meaning when Mobil App Usage goes up by 1 standard deviation, Adaptive Capability also goes up by 0.450 of its own standard deviation.
Shaping Opportunities	<---	Absorptive Capability	.994	***	Absorptive Capability has a positive and significant effect on Shaping Opportunities as its p-value (***) is lower than .05. Meaning when Absorptive Capability goes up by 1 standard deviation, Shaping Opportunities also goes up by 0.994 of its own standard deviation.
Shaping Opportunities	<---	Innovative Capability	-.248	***	Innovative Capability has a negative and significant effect on Shaping Opportunities as its p-value (***) is lower than .05. Meaning when Innovative Capability goes up by 1 standard deviation, Shaping Opportunities also goes down by 0.248 of its own standard deviation.
Sensing Opportunities	<---	Absorptive Capability	.859	***	Absorptive Capability has a positive and significant effect on Sensing Opportunities as its p-value (***) is lower than .05. Meaning when Absorptive Capability goes up by 1 standard deviation, Sensing Opportunities also goes up by 0.859 of its own standard deviation.
Sensing Opportunities	<---	Innovative Capability	-.148	***	Innovative Capability has a negative and significant effect on Sensing Opportunities as its p-value (***) is lower than .05. Meaning when Innovative Capability goes up by 1 standard deviation, Sensing Opportunities goes down by 0.148 of its own standard deviation.
Seizing Opportunities	<---	Absorptive Capability	.946	***	Absorptive Capability has a positive and significant effect on Seizing Opportunities as its p-value (***) is lower than .05. Meaning when Absorptive Capability goes up by 1 standard deviation, Seizing Opportunities also goes up by 0.946 of its own standard deviation.
Seizing Opportunities	<---	Innovative Capability	-.267	***	Innovative Capability has a negative and significant effect on Seizing Opportunities as its p-value (***) is lower than .05. Meaning when Innovative Capability goes up by 1 standard deviation, Seizing

					Opportunities goes down by 0.267 of its own standard deviation.
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*** indicates significant relationship at the level 0.0001